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SIMULATION OF AN OFFSET WALL TURBULENT JET FLOW

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Abstract *Jet flows are commonly observed in many real-world situations, such as in the exhaust plume from a rocket, the airflow from a jet engine or combustion equipment. The jet flow is a high-speed stream of fluid expelled from a relatively narrow orifice into a surrounding fluid with a lower velocity. Factors such as the jet velocity and pressure, size and shape of the orifice, and the properties of the surrounding fluid influence the behavior and characteristics of jet flows. The turbulent offset jet is a fundamental problem due to the development of an adverse pressure gradient that causes the jet stream to deviate from the jet centerline (recirculation zone) and get in direct contact with the wall (impingement zone), both leading to increased turbulence, mixing and potentially reduced efficiency, and source of significant heat transfer or fluid-wall interactions, respectively. This study aims to model the fluid flow phenomena of a jet flow offset from a wall using Computational Fluid Dynamics (CFD) and to validate the model with experimental data published in the literature. The jet model is a 2D, incompressible and turbulent flow in which the jet is discharged into still air. Due to the presence of a lateral wall, it deflects and impinges onto a flat surface. Several RANS (Reynolds-averaged Navier–Stokes equations) turbulence and wall treatment models are tested and compared with the experimental data. The validation process was verified, and the turbulence models agreed with the experimental data. The k-ε model shows a better agreement with the experimental model to the detriment of the k-ω model. Using the k-ε model to describe 2D turbulent incompressible jet flows has shown to be a good choice according to the experimental data.*